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28/9/23

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REPORT OF THE BOMBAY BACTERIOLOGICAL LABORATORY FOR THE YEAR 1922.

Staff.

Staff.

1. This report deals with the work carried out at the Laboratory during the year 1922. Lieut.-Col. Wm. Glen Liston, C.I.E., M.D., D.P.H., I.M.S., was the Director of the Laboratory till September 1922. Since his departure on leave Major J. Taylor, D.S.O., M.D., D.P.H., I.M.S., acted as Director till the end of the year.

The Director was assisted by the following officers :—

(1) Major J. Taylor, D.S.O., M.D., D.P.H., I.M.S., from 24th July to 3rd September 1922.
(2) Major J. Morison, M.B., D.P.H., I.M.S., from 6th April to 31st December 1922.
(3) Dr. D. A. Turkhud, M.B., C.M. (Edin.), from 1st January to 25th March 1922.
(4) Dr. S. N. Gore, L.M. & S., from 1st January to 31st December 1922.
(5) Dr. M. B. Soparkar, M.D. (Bom.), from 1st January to 24th July 1922.

Arrangement of the Report.

Arrangement of the Report.

2. The report has been divided as usual into two parts dealing with the work done under separate heads—

(*i*) The Laboratory where all the anti-plague vaccine used in India and its dependencies is made, and where investigations connected with plague are carried out, and

(*ii*) The Bombay Bacteriological Laboratory where work connected with preventive medicine and pathological diagnosis for the whole of the Bombay Presidency is carried out.

PART I.

Work Connected with Plague.

(*a*) Routine Work.

Manufacture and distribution of the Plague Prophylactic.

Output in doses of anti-plague vaccine for the past five years.

3. The table below gives comparative figures of output in doses of anti-plague vaccine for the past five years. In these figures the dose of the vaccine is reckoned as 4 c.c. but when used within three months of the date of manufacture a dose of only 3 c.c. is recommended :—

Year.	
1918	1,543,099
1919	1,011,175
1920	1,468,729
1921	823,230
1922	972,037

From the opening of the Laboratory in 1896 up to the end of the year, 22,114,137 doses of the vaccine have been sent out.

Distribution of anti-plague vaccine.

The distribution of anti-plague vaccine in India and foreign countries during the last two years is shown below :—

(Figures represent the number of doses.)

Place or Province.	1921.	1922.
Bombay Presidency and Sind	39,874	142,100
Madras Presidency	141,846	306,822
Bengal, Bihar and Assam	24,160	17,184
United Provinces of Agra and Oudh	22,512	94,926
The Punjab	33,500	46,134
North-West Frontier Provinces	3,084	9,012
Central Provinces and Berar	44,502	36,822
Burma	51,126	92,648
Native States in India	93,158	135,643
Countries outside India	369,143	90,692
Portuguese Territory in India	320	54
Total number of doses	823,230	972,037

The following table shows the number of doses of anti-plague vaccine despatched monthly during the past two years :—

Month.	1921.	1922.
January	169,582	71,592
February	102,350	75,810
March	68,482	47,576
April	18,816	38,518
May	57,632	12,150
June	27,770	30,240
July	38,816	49,650
August	107,364	84,662
September	77,856	92,959
October	63,728	147,524
November	56,358	206,450
December	34,476	114,906
Total	823,230	972,037

(*b*) ASSISTANCE AND ADVICE RENDERED.

4. The Health Department of the City of Bombay continued to send to this Laboratory rats found dead or caught alive within

Examination of rats for plague.

the Municipal limits. With each rat a note was received indicating where it had been caught or found, so that after examination it was possible to inform the Health Officer where plague infected specimens had been caught or picked up. The Health Officer was thus able to know definitely from day to day the progress of the disease among rats in the different parts of the City.

During the year 1922, 755,938 rats were received at the Laboratory. Of this number 276,408 were alive when received, and 479,530 were dead. Of the latter 344,546 were examined, and among them 6,404, (1·9 per cent.) were found to be plague-infected.

The following table shows the progress of plague among men and rats in Bombay City during each half month of the year 1922. The figures which refer to human mortality, record the number of deaths from plague each half month. The figures showing the progress of the disease in rats, are given separately for *Mus rattus* and *Mus decumanus*. These figures have been calculated from the number of rats found infected at the examination made at the Laboratory on every day of the week except Sundays and Holidays; from the actual figures thus obtained a figure has been calculated for all the days of each half month, and these are the figures recorded below :—

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Return of rats examined during the year 1922.

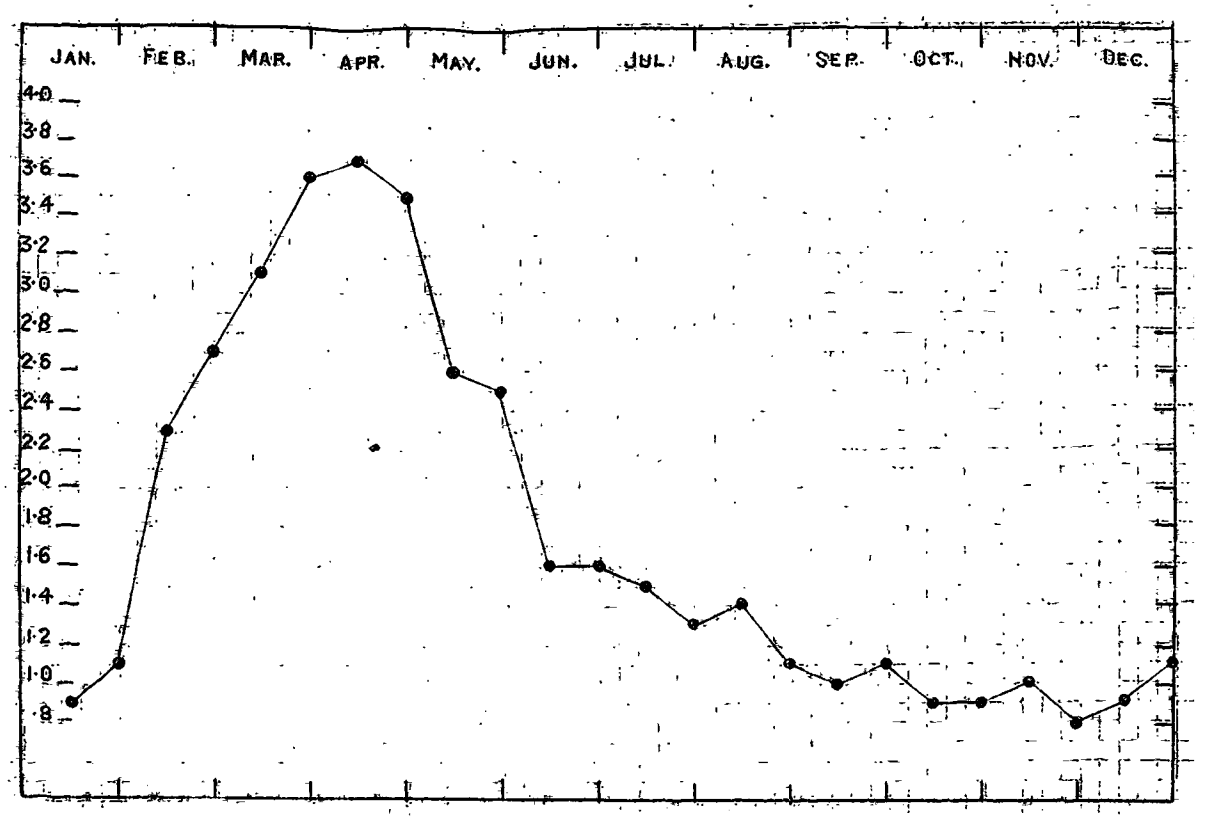
	Human Plague Mortality.		Plague infected *Mus rattus*.		Plague infected *Mus decumanus*.	
	Number of deaths from Plague.	Percentage above or below mean for the year.	Figures calculated for each half month.	Percentage above or below mean for the year.	Figures calculated for each half month.	Percentage above or below mean for the year.
1922.						
1st to 15th January	5	— 76	24·5	- 50	136·4	- 52
16th to 31st January	22	+ 5	48·0	- 3	240·0	- 15
1st to 15th February	27	+ 29	75·0	+ 52	438·5	+ 55
16th to 28th February	29	+ 38	84·5	+ 71	458·9	+ 62
1st to 15th March	42	+ 100	90·0	+ 82	610·0	+ 115
16th to 31st March	46	+ 119	88·6	+ 79	771·7	+ 172
1st to 15th April	72	+ 243	102·3	+ 107	769·1	+ 171
16th to 30th April	57	+ 171	87·5	+ 77	651·2	+ 130
1st to 15th May	42	+ 100	63·5	+ 29	387·7	+ 37
16th to 31st May	25	+ 19	56·6	+ 15	352·0	+ 24
1st to 15th June	11	- 48	21·9	- 56	219·2	- 23
16th to 30th June	10	- 52	28·7	- 42	193·7	- 32
1st to 15th July	8	- 62	39·2	- 21	136·2	- 52

16th to 31st July...	...	...	9	– 57	35·7	– 26	125·5	– 56
1st to 15th August	...	...	12	– 43	38·2	– 25	136·4	– 52
16th to 31st August	...	...	15	– 29	32·0	– 35	137·8	– 51
1st to 15th September	...	...	7	– 67	21·8	– 56	130·9	– 54
16th to 30th September	...	...	7	– 67	38·7	– 22	135·0	– 52
1st to 15th October	...	...	14	– 33	61·2	+ 24	74·0	– 74
16th to 31st October	...	...	4	– 81	33·2	– 33	112·0	– 60
1st to 15th November	...	...	14	– 33	47·5	– 4	122·5	– 57
16th to 30th November	...	...	9	– 57	21·9	– 56	129·2	– 54
1st to 15th December	...	...	9	– 57	20·8	– 58	135·5	– 51
16th to 31st December	...	...	2	– 90	23·3	– 53	192·0	– 32
	Total	...	498	...	...	...	...	...

The following table shows the number of rats examined by two-weekly periods and the numbers and percentages found to be plague infected :—

—	Human plague mortality.	Number of rats examined.	Total infected Plague rats.	Percentage.
1922.				
1st to 15th January ...	5	13,470	118	·9
16th to 31st January ...	22	21,961	252	1·1
1st to 15th February ...	27	19,126	445	2·3
16th to 28th February ...	29	15,203	418	2·7
1st to 15th March	42	17,848	560	3·1
16th to 31st March ...	46	19,545	699	3·6
1st to 15th April	72	17,501	639	3·7
16th to 30th April ...	57	16,990	591	3·5
1st to 15th May	42	14,793	389	2·6
16th to 31st May	25	13,353	332	2·5
1st to 15th June	11	11,582	189	1·6
16th to 30th June ...	10	10,856	178	1·6
1st to 15th July	8	10,163	152	1·5
16th to 31st July	9	10,222	131	1·3
1st to 15th August ...	12	9,184	128	1·4
16th to 31st August ...	15	12,167	138	1·1
1st to 15th September ...	7	10,976	112	1·0
16th to 30th September ...	7	12,485	139	1·1
1st to 15th October ...	14	14,060	123	·9
16th to 31st October ...	4	13,327	118	·9
1st to 15th November ...	14	13,811	136	1·0
16th to 30th November ...	9	16,683	131	·8
1st to 15th December ...	9	16,014	138	·9
16th to 31st December ...	2	13,326	148	1·1

The chart following shows the same evidence in graphic form indicating a rapid rise in plague-infected rats in February and a rapid fall in May and June.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2·4
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1·4
1·2
1·0
·8

(c) Educational Work.

5. (1) During the year two medical men underwent a course of practical training in Bacteriology at the Laboratory.

(2) Two Sub-Assistant Surgeons from Central Provinces attended the Laboratory under the orders of the Inspector General, Civil Hospitals, Central Provinces, Nagpur, and were trained in Bacteriology and Pathology.

(3) Two Sub-Assistant Surgeons were trained in Bacteriological technique, *e. g.*, cultural media making, examination of pathological sections, etc., to assist Research Workers, under the orders of the Indian Research Fund Association, Simla; one of these Sub-Assistant Surgeons was reverted to his former post before the completion of his course.

PART II.

Work of the Laboratory as the Provincial Bacteriological Laboratory.

(a) Routine Work.

I.—Examination of pathological fluids and discharges, water, foodstuffs, etc.

Examination of Pathological fluids and discharges, water and foodstuffs.

6. (1) Blood sera for agglutination for typhoid, paratyphoid and Malta fevers, etc. ... ... 83 specimens.

(2)	Blood for Wassermann reaction	...	817	,,
(3)	Blood smears examined ... 131 Blood counts made ... 16		147	,,
(4)	Sputa for B. tuberculosis or other organisms		47	,,
(5)	Throat swabs for diphtheria, meningococci, pneumococci, etc.		9	,,
(6)	Urine and fæces—			
	Urine for general examination, tuberculosis, cholera, bilharziaosis, etc.		76	,,
	Fæces for cholera, dysentery, typhoid, etc.		29	,,
(7)	Smears of pus for gonococci, meningococci, etc.		8	,,
(8)	Fluids and discharges		38	,,
(9)	Cultures of organisms for identification ...		3	,,
(10)	Smears from rats for the presence of bacillus pestis		94	,,
(11)	Specimens examined for the presence of leprosy bacilli		7	,,
(12)	Milk samples		53	,,
(13)	Water—			
	Chemical examination 121 Bacteriological examination 50		171	,,
(14)	Foodstuffs examined or analysed ...		11	,,
(15)	Miscellaneous examination of gas, tallow, soda, ash, clay, soda water, etc. ...		19	,,

(16) Brushes examined for Anthrax ... 35 specimens.
(17) Disinfectants tested ... ... 5 „
(18) Post-mortem examinations carried out on animals received from the Victoria Gardens. 45 „
(19) Snake for identification ... ... 1 „

II.—Pathological tissues for diagnosis.

7. During the year 1922 two hundred and sixty-one Pathological tissues were received for diagnosis.

Classification of Morbid tissues sent for examination.

Tumours.		
A. Non-malignant ...	...	22
B. Malignant ...	...	47
Granulomata	...	19
Other Pathological conditions ...	...	173
Total	...	261

III.—Diagnosis of Rabies.

8. The following is the statement of the examination of brains of dogs and other animals for the diagnosis of rabies during the year 1922 :—

Examination of dogs, etc., for rabies.

Bombay :—

Through the Bombay Veterinary College ...	...	74
Through the Bombay Police ...	...	39
Through private owners ...	...	10
From other places in Bombay City	...	23
From outstations	...	60
Total	...	206

The result of examination of these animals was as follows :—

Received in a condition unfit for examination	...	12
No evidence of rabies ...	...	34
Negri bodies found, brains obtained from rabid animals	...	160
Total	...	206

IV.—Antirabic Treatment.

9. Antirabic treatment was begun on the 8th April 1922. As long ago as 1909 it was proposed by the Director then Lieutenant-Colonel W. B. Bannerman, I.M.S., that a branch of the Pasteur Institute, Kasauli, should be opened at this laboratory. The proposal was approved by the Government of Bombay in General Department Resolution No. 6307, dated 10th December 1909; but technical difficulties

Antirabic treatment.

seemed to stand in the way of establishing such a branch and financial considerations delayed the formation of a separate Institute.

The establishment of antirabic work in Bombay had, however, become urgent. Increasing numbers went the long journey to Kasauli or to Coonoor which had the effect of straining the accommodation at these Institutes. It was decided, with the approval of the Government of Bombay that a start should be made without further delay, utilising the existing staff and buildings.

The vaccine adopted is the carbolised fixed virus introduced in 1912 by Sir David Semple and used in all the Pasteur Institutes in India. The strain of fixed virus was obtained from Kasauli. The prepared vaccine is bottled in ampoules containing 5 c.c. and 25 c.c. or one and five doses respectively. It is stored in a refrigerator till required.

From the first it was intended that the treatment should be made available near the homes of those requiring it. With this object, as soon as the production of the vaccine was sufficiently developed to permit of an adequate supply, centres for treatment were opened, with the co-operation of Civil Surgeons, at Karachi, Ahmedabad, Ahmednagar, Poona and Belgaum.

Though the official announcement, that antirabic treatment was available within the Province, was not made till September, four hundred and twenty-nine persons were treated at this Laboratory between 8th April and 31st December and treatments for 246 cases were issued to the out centres.

Full statistical information of the cases treated at Parel have been drawn up in the form of the tables used at Kasauli and these are available for reference; but are too elaborate for inclusion in this report.

Sixty per cent. of the cases were bitten in Bombay City itself and 45 or 10·5 per cent. came to Bombay for treatment from other Provinces, Goa, Aden and Native States.

Three hundred and sixty-five patients were Indians, sixty-four were Europeans.

Dogs accounted for 405 cases, jackals for 7 and other animals for 17.

There were no deaths among the Europeans and four among the Indians.

The fatal cases were, one adult and three children aged 5, 5 and 8 years.

There were no deaths during treatment and none within 15 days of the termination of the treatment.

Of the Indians 255 out of a total of 365 began treatment within four days of being bitten and 186 or just more than half began within two days of being bitten.

The average number of bites per case was 3·4.

Only ten out of 365 cases had been licked on abrasions and not actually bitten. This very low number—about one-thirtieth of the proportion of licks treated at Kasauli is due to the opportunities afforded for early examination of the patient and the elimination of those licked on unbroken skin, many of whom would otherwise have found their way to Kasauli or Coonoor.

In addition to those treated one hundred and seventy-five were advised that treatment was not necessary. This represented 25·9 per cent. of all the persons presenting themselves. The proportion of such advice cases at Kasauli during 1921 was 6·45 per cent. The difference in the two figures is brought about by the early examination of the patient and by the search for and observation of the dog by the patient himself, the former rarely possible and the latter generally neglected when the patient has to leave for a distant Institute.

Only thirty-seven cases refused treatment. Out of these 37, three are known to have died of hydrophobia.

These thirty-seven were not among the most severely bitten; for such always continue to come to have their wounds dressed.

They seem to form a fair control population whose mortality 8·1 per cent. contrasts with the low mortality of 1·09 per cent. among those Indians who were treated.

At the branch centres 246 cases received antirabic treatment. Only one death from hydrophobia has been reported, but the returns from these centres are not complete.

The centres at Karachi, Poona and Belgaum were visited and the work was found to be progressing satisfactorily.

The total number of cases treated at Bombay and at the branch centres during the first nine months of this work is, therefore, 675 or more than were treated at Kasauli during the fourth year of its existence. As the provisions for treatment have become known the demand for vaccine especially at out centres has increased.

It has not been possible even in Bombay to get an estimate of the persons who have been bitten by rabid animals and who have not been treated; but thirteen cases of hydrophobia, all of whom had had no antirabic treatment have been visited in Bombay during the last nine months of 1922.

V—The preparation of Vaccine.

Vaccines.

10. In addition to the plague vaccine details of which are recorded elsewhere the following vaccines were prepared at the Laboratory and supplied both to military and other bodies in and out of India:—

Autogenous vaccines prepared for 339 cases.

Stock vaccines—

Staphylococcus	...	...	70 c.cs.
Streptococcus	...	...	6 ,,
Gonococcus	...	...	24 ,,
Tuberculin	...	...	101 ,,
Anticholera	...	...	7,945 ,,
Mixed T. A. B.	...	...	1,785 ,,
Leprosy	...	...	1,510 ,,
Influenza	...	...	4,795 ,,

VI—Snakes.

11. The following poisonous snakes were received alive at the Laboratory :—

Place.	Cobras.	Russell's vipers.	Krait.	Echis.
Narsinghpur	1	.....	.....	.....
Bharatpur	3	.....	.....	.....
Ranebennur	2	.....	.....	.....
Bombay	3	5	.....	.....
Total ...	9	5	.....	.....

Total number of snakes received alive ... 14.

Snakes.

Venom was collected periodically from the cobras and Russell's Vipers. It was dried and sent to the Central Research Institute, Kasauli, where the antivenine is prepared.

The bulk of dried venom now in stock is :—

Russell's Viper	...	...	400 grammes.
Cobra	...	...	750 ,,
Echis	...	...	20 ,,

(*b*) Research Work.

12. During the past 12 months Professor Hamilton Fairley, O.B.E., has been conducting researches on the experimental and clinical aspects of Guinea-worm disease and Bilharziosis.

Guinea-worm Disease.

(1) Studies undertaken in conjunction with Lieutenant-Colonel Glen Liston, C.I.E., I.M.S., showed three different etiological agents to be responsible for the pathological and clinical manifestations of Dracontiasis. The *Guinea-worm* by the production of some toxic substance produced the early systemic manifestations such as urticaria, cyanosis, vomiting, giddiness, fainting and diarrhoea, while locally it was responsible for blister formation. The *embryos* if confined under pressure in the subcutaneous tissues were shown to produce a sterile subacute chemical abscess but

otherwise were innocuous to the host. Easily the most serious factor is *Bacterial infection* which was responsible for all the septic complications including local abscess, cellulitis, synovitis and arthritis, culminating in the common deformities. The cultural findings in 39 complicated cases showed *S. aureus, B. coli* and streptococci to be mainly implicated. The mechanism of secondary infection was worked out in detail, and the existence of a fibrous tissue sheath surrounding the parasite definitely demonstrated in microscopical sections. The cellular humoral response was also studied. Eosinophilia was fairly constant but antibody could never be demonstrated by the Bordet-Gengou reaction nor did the intravenous injection of extracts of the adult female worm and its embryos lead to its elaboration. The clinical picture was analysed in 150 cases and various methods of treatment tried out. The observations of Macfie on the efficacy of tartar emetic were not confirmed and this treatment was abandoned. A new operation performed under local anæsthesia and based on pathological considerations has been devised for the removal of the adult female in the subcutaneous tissues. The results have proved highly satisfactory in a series of 20 cases so treated.

Bilharziosis.

(2) Two factors namely the return of infested troops from Mesopotamia (*Schistosomum Haematobium*) and the wide spread adaptability shown by the cercarial stage of this schistosome for widely different genera of molluscs have emphasised the danger of human Bilharziosis becoming endemic in this country. Prophylactic measures have been restricted to treating infected cases with varying amounts of tartar emetic it being commonly held that the disease is thereby eradicated. Investigations in this Laboratory during the past year suggest that the ordinary criteria of cure namely the disappearance of living ova from the excreta are not altogether satisfactory from the public health view point. A specific serological reaction has been devised which yields a much more accurate index to the fate of the adult worms. Twenty-five cases of human Bilharzia which have undergone treatment have been kept under observation. Serological investigations have been made at two monthly intervals the test being used to control the effect of treatment in a similar manner to the Wassermann Reaction in Syphilis. In many cases positive reactions have persisted but final conclusions are not yet available. Sixty goats have been experimentally infected with *S. spindalis*, and the detailed pathology, serology and therapy studied. The complement fixation reaction has invariably become positive within six weeks of infection. Positive reaction have never been observed by animals other than those suffering from some species of Mammalian Bilharzia. The test has been shown to be of the nature of a group reaction for Mammalian Bilharzia, infestations with *S. spindalis, S. haematobium* and *S. indicum*, all giving the reaction with spindalis antigen. The concentrated alcoholic extract of infected livers of *Planorbis exustus* was shown to be a very stable antigen, easily prepared and capable of manufacture on a commercial scale. In animals infested with *S. spindalis* tartar emetic was found

to exert a definite lethal effect on a majority of the Schistosomes in the venous system but only exceptionally was complete cure established in heavily infested goats, the general rule being for a certain number of antimony resistant parasites to survive even prolonged courses of treatment. In consequence of the reduction of the number of parasites, ova and toxic substances were not elaborated in sufficient quantity and concentration to damage severely the tissues of the host. Indeed even in hyper-infections life was saved and health restored but despite this fact complete eradication of the disease was infrequent and living ova were demonstrated in the mucoa of the intestine even after prolonged treatment and when repeated examination of the fæces for ova was negative. It was generally not possible to convert positive serological reactions to negative ones by the administration of tartar emetic but where this result was accomplished autopsy showed that complete cure had been established. The theraupeutic value of tartar emetic, collosal antimony, urea stibamine and emetine hydrochloride is at present being compared in a series of animals experimentally infected with *S. spindalis*.

A simple method for the bacteriological examination of water.

(3) Dr. S. N. Gore has devised a simple method for the bacteriological examination of water. It is based on the detection of indole-producing bacteria which include all the true B. coli as well as many of the dysentery bacilli, and the cholera and Cholera-like vibrios. In this method an approximate idea of the total number of organisms growing on agar-agar is obtained by means of seeding a 5 m.m. platinum loopful and a 1 m.m. loopful of the sample each on an agar slope. The 5 m.m. loop holds on an average 0·025 c.c of water while the 1 m.m. loop holds about one-tenth of this quantity, *viz.*, 0·0025. A paper on this method was read at the Indian Science Congress held at Lucknow in January 1923. This method is so simple that it could be carried out in the field by any medical or even a non-medical man with a minimum of training.

The requirements for this test consist of (1) a few small test tubes containing about 0·5 c.c. of 5 per cent. solution of peptone, and others containing about 2·5 c.c. of 1 per cent. solution of peptone, (2) a few agar slopes, (3) a 5 m.m. and a 1 m.m. platinum loop mounted on aluminium handles or glass rods, (4) a measuring pipette marked at 2·5 c.c., 0·5 c.c., and 0·1 c.c., (5) a few sterilised test tubes (6) a test tube holder, (7) a spirit lamp, (8) Böhmé's solutions* (9) a thermos flask to serve as an incubator in places and seasons where the temperature happens to be below 25°C. during the greater part of a 24 hours' day, (10) and a thermometer. All this apparatus could be arranged in a small box like Houston's water sample box †.

A* Potassium persulphate ... 1 gramme.
Distilled water ... 100 cubic centimeters.

B Para-dimethyl-amid-benzaldehyde ... 1 gramme.
Absolute alcohol ... 95 cubic centimeters.
Hydrochloric acid ... 20 „ „
These two reagents are conveniently stocked in drop bottles.

† Arrangements are being made to put up such sets for sale.

Description of the method.—(1) Collect the sample of water in a sterilized test tube or one which has been sterilized on the spot by boiling water in it. (2) By means of the pipette place 2·5 c.c. of the sample of water in the 5 per cent. peptone water tube, and 0·5 c.c. and 0·1 c.c. each in two 1 per cent. peptone water tubes. By means of the platinum loops inoculate a third and a fourth 1 per cent. peptone water tubes with a loopful each of the sample. (3) Lastly spread one 5 m.m. and 1 m.m. loopful of the sample each on an agar slope. All the inoculated tubes should be marked accordingly. (4) Add sufficiently warm water to the thermos flask, place the inoculated tubes in it, and stopper the flask. (5) After 24 hours remove the tubes, count the number of colonies that may have grown on the agar slopes and then examine the peptone water tubes for the presence of indole in the following way :—Remove the white absorbent cotton wool plug and moisten its lower surface first with a drop of the persulphate solution and then with one of the para-dimethyl-amids-benzaldehyde solution. Replace the plug and heat the upper layers of the culture in a low flame, as is done in applying the heat test for detecting albumen in the urine. If indole is present in the culture, the moistened undersurface of the cotton wool plug will begin to become pink as soon as the liquid boils and volatilizes. If after a minute's boiling, the undersurface of the plug does not show any pink colour the result is taken as negative. The testing for indole is commenced from the smallest quantity onwards. For example, in the set of five inoculated peptone water tubes containing 2·5 c.c., 0·5 c.c., 0·1 c.c., and the loopfuls (= ·025 c.c. and ·0025 c.c.) of the water, the testing is commenced with the last tube, and if this proves negative, the next higher tube is examined for indole and thus the smallest quantity of water containing indole producers is determined.

Nutritional values of heated blood agar.

(4) Dr. M. B. Soparkar carried out experiments to determine the effect of varying degrees of temperature upon the nutritive qualities of blood when added to a plain medium for the cultivation of the hæmophilic organisms. The following are the conclusions arrived at :—(1) Unheated blood affords a poorer growth of *B. influenzæ* than heated blood. (2) The growth-promoting quality of heated blood is gradually developed as the temperature used in heating rises. (3) The maximum development of this growth-promoting quality in the case of *B. influenzæ* takes place for a temperature of 67° to 70°C. applied for 10 to 15 minutes. (4) Heating the blood used in the medium at temperatures beyond the optimum leads to a gradual destruction of this quality. (5) The luxuriance of growth of *B. influenzæ* upon heated blood media depends, within certain limits, upon the concentration of blood in the medium.

(*c*) Educational.

13. Special demonstrations were arranged for the students of Poona High School, Sorabji Bengali Girls' School, Palanpur High School, and the College of Agriculture, Poona.

A series of lectures on "Diseases" was given this year to the teachers under training in the Secondary Training College.

Facilities were given to Rev. Father J. F. Caius of the St. Xavier College to carry out his work.

At the request of the Agency Surgeon and the Kathiawar Medical Society, lectures on "Insects and Disease" were given at Rajkot by the Director, and Khan Bahadur C. R. Avari, B. M. S., of the Laboratory.

A number of sets of magic lantern slides on plague, tuberculosis, guinea-worm, malaria and milk were prepared at the Laboratory and issued to the Station Municipality, Bangalore, Anti-tuberculosis League, Lucknow, and the Health Officer, Surat Municipality.

A set of cinema films were sent on loan to the Medical Officer of Health, Municipal Committee, Lahore. Enlarged photographs illustrating the various phases of the diseases were also given to the Health and Welfare Exhibition, Bangalore, on loan.

F. P. MACKIE,
Lieut.-Colonel, I.M.S.,
Officiating Director,
Bombay Bacteriological Laboratory.

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